WHITE PAPER

Electronic Manufacturing Strategies and Mass Communication: a Perfect Fit

The revolution that's taking place is freeing up manufacturers to do what they do best – staying aligned with their customers over the lives of multiple products.

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Introduction

There is a global revolution going on in the approaches manufacturing companies are taking to define, manufacture and service their products. It's much more fundamental and powerful than just following low-cost manufacturing centers around the globe. The revolution that's taking place is freeing up manufacturers to do what they do best – staying aligned with their customers over the lives of multiple products. Increasingly, manufacturing companies are finding that by strategically focusing on just a few top priorities, and not trying to handle the entire value chain of how they create, manufacture and service products on their own, they are becoming more competitive. The era of outsourcing every process that is not directly aligned with serving the customer has arrived.

The processes being offloaded span the entire value chain of industries. Starting with the many facets of new product development and design and progressing through project and service collaboration, which is essential for a strong product introduction, and into ongoing supply-chain management and integration, the value chains of entire industries are being made more efficient and profitable through the use of Electronic Manufacturing Services (EMS) firms. For clarification in this white paper, firms offering EMS services are called EMS providers.

Today these firms span the value chains of the world's most complex manufacturing environments. Their beginnings started with helping manufacturers get more life out of their products that were edging toward commodity status – where price became the only differentiator.

The intent of this white paper is to show, through the convergence occurring in the cell phone industry, how manufacturers face a unique set of challenges that start with defining innovative new products on the one hand, and the managing of costs over the life of products on the other. Given the fact that any given cell phone's product life cycle – the time period it is sold in the market – is shortening dramatically, the challenge for manufacturers to keep pace is clear. Staying ahead of the market starts with getting focused on what each does best; that's why Electronic Manufacturing Services firms are a viable alternative for many manufacturers.

Why Electronic Manufacturing Services Are Gaining Momentum

In many industries such as cell phones, portable electronics and personal computers, manufacturers are under constant pressure to drop the cost of manufacturing their products. Moore's Law, originally defined by Gordon Moore, a founder of Intel Corporation, states that chip density roughly doubles during every product generation. Defined over 40 years ago, the law has been proven repeatedly throughout the electronics industry. One of the biggest fallouts of this law for manufacturers is the fact that for many, pricing has become the only way to make a product that is different from those of competitors. When pricing becomes the only way to differentiate, entire areas of high-tech change – fast.

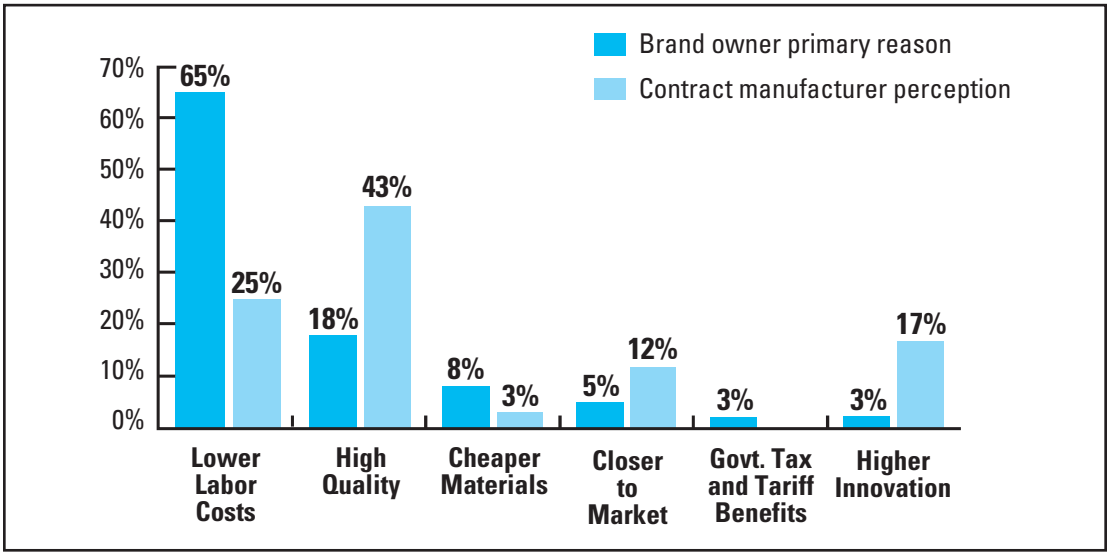
Dropping the cost of producing any product – from a cell phone to a complex mainframe server – is one of the prime market drivers making Electronic Manufacturing Services grow so rapidly. Here are additional factors that are driving this area's growth:

- **Rapid and unpredictable commoditization of electronics** – The time frame in which a company can recoup any advantage from its new Intellectual Property (IP) advantage alone is shrinking. The days of relying solely on the execution of a product roadmap are rapidly ending as convergence and consolidation together are redefining entire market segments – as is certainly the case with cell phones. It's not enough to just have IP or even a roadmap anymore. The ability to sense and respond in a synchronized strategy to meet market demands will spell the difference for many companies when it comes to long-term survival.
- **Trusted globalization of outsourcing** – Global outsourcing continues to gather momentum. For years, manufacturers have outsourced the production of their products. The momentum toward increasing outsourcing trust for many aspects of product development, manufacturing, and service strategies shows that as a strategy, it's here to stay. And, as an approach to product development, it has significant potential to enable manufacturers to focus on their core strengths.
- **Evolving business models are revolutionizing value chains** – Simply put, the need for manufacturers to be more adaptable to rapidly changing costs structures points to a rise in component supply hubs. In addition, it is changing the relationships between component suppliers, distributors, EMS providers, OEMS, and Outsource Design Manufacturers (ODMs).
- **Emergence of the Outsource Design Manufacturer (ODM)** – ODMs function as OEMs in that they offer turnkey design and manufacturing solutions. The ODM owns the product design, development, and manufacturing, but then uses the marketing and distribution channels of its OEM customer to sell products.

- **Rapid construction and decommissioning of plants** – When the lack of market demand obsoletes products, there is a period of time required for a company to ramp-up a manufacturing facility for new divisions and to decommission a production plant. The time required to complete the commissioning and decommissioning of factories is shrinking. The most competitive businesses have achieved a ramp-up time of 12 weeks or less to bring a new contractor facility up to production.
- **Distributed liability/Vendor-Managed Inventory (VMI)** – OEMs and EMS providers are increasingly less willing to accept ownership of materials and components until they are actually consumed or delivered. As a result, manufacturers are relying more than ever on software-based approaches to managing distributed liability of inventory, and handling vendor-managed inventory efficiently.
- **Managing product End of Life (EOL) including channel redirection and product obsolescence** – Intellectual Property (IP) itself doesn't guarantee last competitive advantage because shorter product life cycles are driving product obsolescence. Companies are developing skills in redefining channel strategies to maximize sales of older products.
- **The need for adhering to market-proven standards** – There are really two classes of standards that influence high-tech manufacturers. The first is market-driven while the second is based on standard organizations that define standards and approaches to entire industries working together. Electronic manufacturing service providers have actually helped to define the market-based standards for product development and ongoing production. In addition, several are involved in the standards-making organizations that look to streamline supply-chain coordination through their industries.
- **Web Services are ready for prime time** – The rapid growth of XML-based communication, including the growth of Web Services for managing business processes globally, has arrived.
- **Manufacturing is now virtual** – This is due to the fact that Web Services along with XML-based communication makes it possible to attain higher levels of global collaboration than ever before.
- **EMS providers directly influence Bill of Material (BOM) and labor costs** – Manufacturers are constantly looking at evaluating EMS as a strategy for reducing bottom-line costs. Up to 60% of a cell phone's BOM costs are controllable through EMS strategies. For example, the market drivers defined here are changing the landscape for the ability of electronic manufacturing services to execute on behalf of manufacturers globally. The technology factors of automating Vendor-Managed Inventory and the successful use of XML and Web Services to virtually collaborate with manufacturers will continue to re-order the landscape of electronic manufacturing services.

Why the Adoption of Electronic Manufacturing Services Is Growing

Lowering the cost to produce products continues to be the main reason for manufacturers to look to electronic manufacturing services. In an AMR Research survey of 700 manufacturers who are working with EMS providers globally, 65% claim that lower labor and production costs are the primary reason for working with outsourcers, followed by 18% mentioning higher quality and 8% citing cheaper materials. What's interesting about AMR's study is the fact that EMS providers see their primary value being high quality (43%) followed by lower labor costs (25%) with higher innovation (17%) being the third reason. Figure 1 shows the results of this survey.

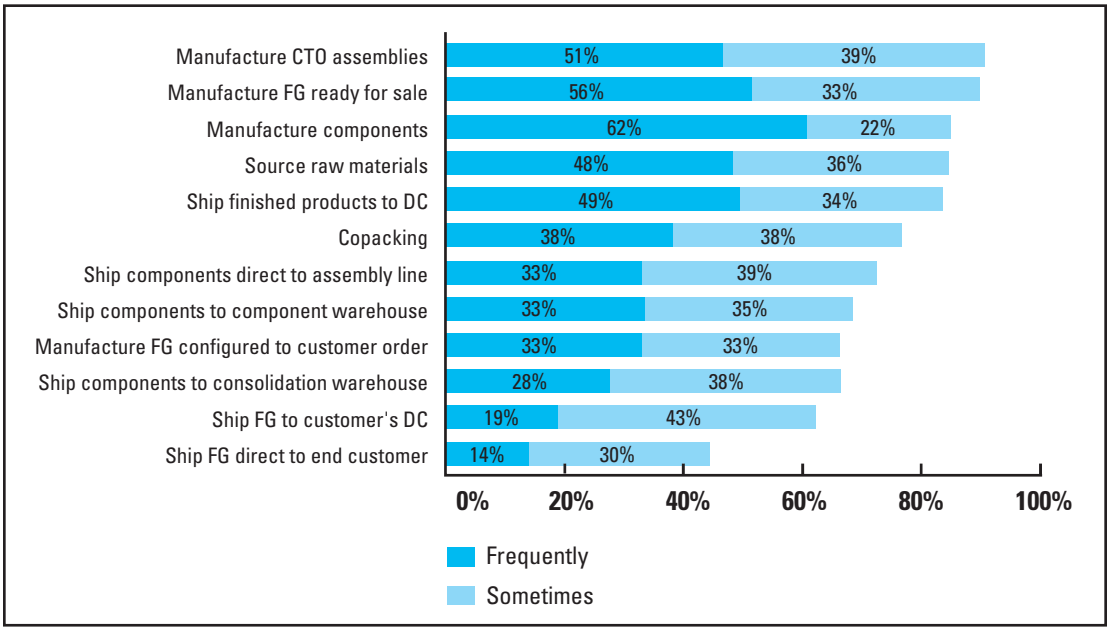


Source: AMR Research, 2005

Figure 1: Comparing Electronic Manufacturing Services Growth Factors

EMS providers see their major contribution as delivering high-quality manufacturing, as this is where the majority of their investment goes. Every EMS provider that has global manufacturing facilities meets ISO-9001 certification – a quality standard specifically developed for manufacturing. Therefore, it is no surprise that they see their first major contribution as being higher quality manufacturing followed by lower labor costs. The gap between how manufacturers view EMS providers versus how they view themselves regarding higher innovation shows the evolving role of the latter on offering design services. Analyst firms are calling this area Original Design Manufacturing (ODM). Simply put, manufacturers are relying on EMS providers to handle the design and development of initial product concepts. Market estimates show that manufacturers are starting to take advantage of this service from EMS providers, yet it is far less dominant with costs being the primary driver.

Before going through the development process that EMS providers and manufacturers rely on for driving labor costs out of products, it's useful to see what products manufacturers target for this strategy. The majority of manufacturers (62) are relying on EMS providers for manufacturing components followed by manufacturing products to-stock, or in other words, finished goods ready for sale (56%). Manufacturing configure-to-order assemblies, which have 30% or less customization to them, are 51% of all products built. High-tech products have by nature become more configure-to-order, or customizable in distribution channels globally. This translates into even greater challenges for EMS providers and manufacturers to synchronize orders and manage supply chains closely to make sure there are enough components to complete orders. Figure 2 shows a ranking of services and frequency of use.



Source: AMR Research, 2005

Figure 2: Services Provided by EMS Providers to Manufacturers

Exploring the Electronic Manufacturing Systems Process for Cell Phones

Given the fact that EMS providers are having a significant impact on both labor and Bill of Material (BOM) costs, their ability to span more processes than just manufacturing is apparent in the cell phone industry for example. The process of creating a cell phone, where EMS providers have reduced BOM costs by 60% or more, is illustrated here. Outsourcing Design Manufacturing (ODM) is included in the following process steps to show its relative contribution to the electronic manufacturing services process:

Phase I: Product Design and Quality

Included within this phase are the following steps (it's up to the manufacturer as to which of these they choose to use). Nearly every EMS provider is starting to offer either part or all of these services. This entire product-development phase is part of the Outsourcing Design Manufacturing (ODM) initiative that is taking place among EMS providers today.

- **Design Services** – In the example of a cell phone manufacturer that is seeking to keep pace with the product life cycles of its specific industries, the decision to use design services makes sense. It frees up the manufacturer to focus on distribution channels and the definition of convergence products that are so critical for the growth of their market. Here are additional steps that the cell phone manufacturer will work through with an EMS provider:
  - Prototyping and ramp-up
  - Product structure management
  - Product development
  - Specification management
  - Document management
  - Change and configuration management

  Cell-phone manufacturers seek differentiation in this stage of a development partnership with EMS providers through the development of innovative, small, form-factor displays, which currently represent 21% of the Bill of Materials (BOM) costs. Such a high-cost component with strong differentiation potential is an example of where cell phone manufacturers are relying on EMS providers to deliver materials cost reductions.

- **Design and Project Collaboration** – In the evolving role of EMS providers as deliverers of Outsourcing Design Manufacturing (ODM) services, this is one of the areas that requires the greatest level of collaboration with cell phone manufacturers. The strategies EMS providers focus on in this area include the following:
  - Development of collaboration best practices
  - Project planning and scoping

- Ongoing project management
- Portfolio and product management
- Project execution

In the case of cell-phone manufacturers, this step in any development process requires a major commitment of resources and focus, since engineering in the EMS provider and the manufacturer need to work together daily in the definition and development of the next generation of product families.

Phase II: Manufacturing

The scope of services has greatly widened within the last 15 years specifically in this area of EMS providers' offerings. This entire industry has rapidly progressed from offering lower labor costs by either building or acquiring production centers in low-wage areas of the world to span an entire range of services in this industry. The strategic segments of this phase of EMS providers' offerings include the following:

- **Order management**
  - Distributed order management in conjunction with manufacturers
  - Outbound order processing
  - Order drop-shipments

- **Supply chain management**

  Demand and Supply Planning – Manufacturers are increasingly relying on EMS providers for coordination of their supply chains. As a result, the growth of services offered has made this one of the fastest growing areas of cell-phone manufacturers' use of electronic manufacturing services. The services that comprise this area are defined later in this document.

- **Manufacturing and assembly**

  This area is the core of EMS providers' value for manufacturers, and is explained in detail later within this document. Manufacturers see improved forecast accuracy, reductions in material and component obsolescence, and lowered inventory write-downs due to using EMS providers.

- **Logistics and distribution**

  For cell-phone manufacturers that rely on EMS providers for each of these specific strategies, there is the need for coordinating demand and supply-chain planning, manufacturing strategies for attaining Six Sigma on production processes, and a strategic focus on quality management.

The following three areas are considered to be the foundations that underscore the manufacturing strategies that EMS providers are offering today. Each of these areas is defined further by their specific offerings.

1. Demand and supply-chain planning

- Demand planning and forecasting
- Safety stock planning
- Supply network optimization
- Multilevel demand, supply matching, and optimization
- Supply network planning logic
- Supply chain monitoring and control
- Production planning

Given the fact that cell-phone manufacturers face continual downward pricing pressure on their products, the ability to manage supply chains to the highest levels of efficiency possible is critical. That's why EMS providers are focused on demand and supply-chain planning as a critical part of their offerings for cell-phone manufacturers. The ability of EMS providers to deliver components at a lower cost than manufacturers can achieve on their own further underscores the fact that EMS is not just for manufacturing anymore. It is increasingly about co-managing a manufacturer's supply chain and making a correspondingly higher contribution to reducing BOM costs. AMR Research, for example, cites a 70% figure of co-managing supply chains between manufacturers and EMS providers.

As pointed out in previous sections of this document, at the core of the EMS providers' value to manufacturers is the continual focus on quality. ISO 9001 is not optional anymore for any EMS provider, and it needs to be at the top of the evaluation list for cell-phone manufacturers that are looking for a potential EMS provider. At the heart of the value of EMS providers are high quality and the predictable production of components, subassemblies, assemblies, and finished goods. The following points highlight the key aspects of EMS providers' focus on manufacturing and quality:

2. Manufacturing and Six Sigma strategies

- Production planning
- Manufacturing execution strategies

Cell phone manufacturers, for example, will rely heavily on production planning services to drive down both labor and production costs for cell phones that are mature in their product life cycles. Manufacturing execution strategies are relied on for the introduction of entirely new products and in the case of cell phones, the development, production, and service of convergence cell phones - for example, those that include digital cameras.

Apart from cost reduction strategies, EMS providers see quality as the most critical value-add they bring to manufacturers. In fact, according to AMR Research surveys, EMS providers see themselves as more in the business of delivering quality production over cost reduction as their primary value to manufacturers. The investment required to accomplish ISO 9001 certification can be well into the millions of dollars, hence EMS providers' focus on this as their core strength and value to manufacturers. In defining their quality strategies, EMS providers focus on the following areas:

3. Quality management

- Quality engineering
- Continuous quality improvement initiatives
- Audit management
- Quality assurance and control

Phase III: Service Management

Post-manufacturing services are the key to profitability for many manufacturers that face increasing pressure on their pricing, and as a result, on their product life cycles. AMR Research estimates that just a 3% capture rate of the installed base for any given manufacturer increases return on sales by 10%. EMS providers are attempting to contribute to this growth in profitability by offering a series of services. Some are calling this Service Life cycle Management (SLM), others are calling it Post-Manufacturing Services, and still others call it Aftermarket Services. Components of EMS providers' strategy are defined here:

- Service parts and operations
- Customer-service management
- Inventory management
- Logistics services

In the case of a cell-phone manufacturer, the aftermarket presents even greater revenue opportunities than the initial sales of cell phones themselves. What several manufacturers (including Cingular, Verizon Wireless, Virgin Mobile, and others) are focusing on is the merging of services offerings; for example, extended warranty plans for phones with mega-pixel cameras, and in many cases, the ability to sell web-based services. The novelty of offering television viewing on cell phones opens up an entirely new range of services and accentuates the need for Service Life cycle Management strategies from EMS providers to align with the long-term upsell potential of the latest entries into the convergence market arena. The melding of mature technologies in the cell phone form-factor promises to revolutionize the growth of this entire area of EMS providers' business models.

Key Success Criteria in Managing Electronic Manufacturing Services

In determining if electronic manufacturing services are a suitable fit, manufacturers need to keep in mind the priorities of their counterparts who are already relying on this strategy, and their impact on the future direction of this approach to streamlining product design, development, manufacturing, and service. AMR Research's extensive work defines the top concerns of existing manufacturers who are using electronic manufacturing services and finding it a viable strategy. Here are the results of research that was conducted by AMR Research in March of 2005. The research uncovered the top concerns of 700 global manufacturers who rely on EMS providers. Multiple responses were encouraged to capture a complete set of priorities.

Top Priorities of Manufacturers Using EMS Providers Today

Planning and managing inventory throughout the supply chain	56%
Managing product quality with the EMS provider	48%
Protecting intellectual property	35%
Visibility to and Response to customer demand and orders	29%
Sharing inventory and production status	25%
Contract coordination	25%
Managing increased variability and uncertainty	21%
Information technology capabilities of EMS providers	19%
Enforcing and ensuring regulatory compliance	15%
Coordinating logistics and cross-border trade	12%
Controlling international logistics costs	10%

Source: AMR Research Report, Contract Manufacturing at a Crossroads: Brand Owner Need for Visibility, April 2005

Electronic Manufacturing Meets Mass Customization

EMS providers are finding that configure-to-order product strategies are working for cell phones, blade servers, and PCs. The future of electronic manufacturing is best viewed from the context of mass-customization strategies, as shown in the following table. Clearly, the future of EMS is to embrace all phases of mass customization. Cincom's Socrates™ application is a proven solution for capturing and managing orders for customized products.

Comparing Mass Customization Strategies

	Definition	Industry Examples
Assemble-to-Order	This is a product configuration strategy that is focused on taking manufactured components or subassemblies and creating a finalized assembly from them. Assemble-to-order product configuration strategies are often rules-based and define the interrelationships and compatibilities between components, subassemblies and parts of a product.	An example of an assemble-to-order strategy is the definition of components in a laptop computer where the product is assembled from a series of stock components. This strategy is found most often in high-tech, channel assembly and electronics. Furniture, retail including DYI (Do It Yourself) stores, packaging, printing, healthcare and insurance are where this configuration strategy is used.
Build-to-Order	Manufacturers who have a build-to-order strategy are customizing smaller portions of the customized product for the unique requirements of customers, with the majority of the products' content being based on made-to-stock or standardized product.	Examples of build-to-order strategies include auto manufacturers that offer several options on engines and interiors. High-tech, automotive, medical, and financial services are several of the verticals where this is used.
Configure-to-Order	Manufacturers of complex products are using this product configuration strategy for customizing their products to an exacting set of specifications from their manufacturing customers. Configure-to-order products are comprised of both standardized and customized components, with the majority being customized to the needs of the customer.	Industries relying on configure-to-order strategies are distinguished by their requirements of intelligence around product constraints. Verticals relying on configure-to-order include telecommunications, heavy industrial equipment, turbine and pump production, elevators and escalators, and complex cabling systems.
Engineer-to-Order	Where the majority, if not all, product components are specifically created to a customer's unique requirements, it's referred to as an engineer-to-order (ETO) strategy. Products manufactured as a result of an ETO strategy are defined with highly specific engineering documents, and often require that the sales configurators delivering quotes from these products have the ability to generate multi-level CAD drawings and specifications.	Products that are manufactured using an ETO process include aircraft, aerospace and defense products, power generators, HVAC equipment, specialty-use engines, and manufacturing equipment that is purposely built to support a specific manufacturing process.

Recommendations and Conclusions

There is a global revolution going on within manufacturing today, driven by accelerated product life cycles, increasing price competition, industry consolidation, and in the cell-phone industry, convergence of technologies that when combined, deliver strongly differentiated products. At the center of this perfect storm of manufacturing, is the need for companies that own brands to:

- Maximize sales in existing channels.
- Look for new and alternative channels that promise higher growth and lower sales costs.
- Grow same-customer sales and maximize their value over multiple products' lifetimes.

Add to this the fact that many manufacturers need to invest more to achieve quality certifications to produce convergence products that they generate in gross contribution margin, and the implications become clear. Electronic manufacturing services are here to stay and will grow rapidly as manufacturers that hold brands focus first on building existing customer relationships and look to acquire new customers with entirely new classes of products.

Recommendations for manufacturers include:

- **Work to create demand visibility throughout manufacturing now.** For EMS-based strategies to work, this level of visibility is critical and will greatly increase the chances of success in adopting electronic manufacturing approaches to production.
- **Standardize contracts with a set of options for design, inventory, manufacturing visibility, and planning responsibility.** Structure contracts consistently to make them easier to manage and change when needed, and include incentive clauses for EMS providers that provide exceptionally responsive service and higher levels of quality than those of which they originally agreed to.
- **Have Quality Assurance and Quality Engineering from your company work early in the process with EMS partners.** Too often manufacturers take too long and often shortchange quality efforts, thinking the strategy of using EMS providers is all about cost reduction. Often manufacturers that turn to EMS providers are nearly out of time in keeping up with product generations anyway, and a quality slip can quickly push a product generation into another year – an irrecoverable blow to any program. So focusing first on your Quality Assurance and Quality Engineering teams is critical to the long-term success of any electronic manufacturing strategy.

- **Focus on technology alternatives for synchronizing market demand including customized product orders with your EMS partners.** Web Services is a market dynamic discussed at length within the market factors that drive adoption of global electronic manufacturing strategies. If your company is looking into EMS as a viable production alternative, start by evaluating how automating channel management, order management, aftermarket or services management, and definitely engineering change orders (ECOs) will impact this strategy. Being able to link EMS partners on what's changing in a product – typically communicated in ECOs – is critical for the long-term success of a product.
- **Look for standardization options for communicating orders and sharing internal content with EMS partners.** For companies in high-tech, RosettaNet is the standard for handling the transferring of orders from one partner to another, and there are many standards in place. Get up to speed on them before embarking on an engineering manufacturing strategy.

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