

CISCO SYSTEMS, INC: SUPPLY CHAIN RISK MANAGEMENT¹

"In an increasingly networked world, supply chain risk management is top of mind in global organizations as well as key differentiator for leading value chain organizations." (John Chambers, Chairman and CEO, Cisco Systems).

James Steele, program director for supply chain risk management at Cisco Systems Inc (Cisco), woke up one morning in March 2011 with an urgent phone call from one of the risk managers and member of one of Cisco's supply chain risk management teams based in San Jose, California. A warning system related to weather monitoring systems alerted of a high probability of suffering a high magnitude earthquake on the east coast of Japan. Once James arrived at his office, the very first activity was to open the map of key locations of facilities for Cisco's electronics components in Japan, and the company's Japanese-sourced suppliers.

The threat came true and, after a 9.0 magnitude earthquake, Japan suffered a tsunami, which caused severe damage, power failures and meltdowns at nuclear facilities. It has been one of the largest disruptions to global supply chain in modern history.

Alarmed, James, got in contact with John Chambers, Chairman and CEO at Cisco Systems, informing him that the incident management protocol for a "Black Swan or "force majeure" event had been activated within the Global Business Operations and Supply Chain Operations Departments, at the highest degree. Steele informed: "Cisco has about 250 tier-1 suppliers in Japan, many of them the sole source for high level

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engineering components”. John Chambers expressed: “The main purpose now is to guarantee continuity of supply; the lowest impact in operations as well as financial performance”. Steele mobilized a team of 10 risk managers to better understand the potential impact of such a disruption. The following morning, Cisco had assembled a 100-person “war room” to figure out which orders were and could be affected, accounting for all of the major suppliers within Japan, at least all the tier ones.¹

The company

Cisco, whose name comes from the city name, San Francisco, was founded in 1984 by Leonard Bosack and Sandy Lerner, a couple working in I.T. at Stanford University. Cisco is the kind of success story that is told very often about Silicon Valley; the idea nurtured at home that reaches world class level.²

Cisco started in the market with routers and switches. Fifteen years after foundation, routers and switches were still core products for the company but they had expanded to include solutions based on their initial products such as Internet Protocol (IP) communication, Call Center systems, Tele-Presence and many other communication related solutions. Cisco solutions can serve from small businesses with minor requirements, such as video-conferencing or wi-fi access points, to big corporations requiring Data Center and Cloud Services.³

Cisco started with an initial funding from the venture capital firm Sequoia Capital and went public 6 years later. That made a market capitalization of US\$224 million, enough to be listed on the Nasdaq stock exchange. In late March 2000, Cisco had become the most valuable company in the world, with a market capitalization of more than US\$500 billion. Eleven years later, in November 2011, a market capital of about US\$94 billion still qualifies Cisco as one of the most valuable companies.⁴

A key moment for Cisco's development was the growth of the Internet in the second half of the 90s and the big change it implied in the telecom market. Once the IP protocol was almost universally adopted, the importance of multi-protocol routing declined and Cisco managed to become a vital supplier in a market whose growth rate was explosive. To keep up with the growth of the Internet, Cisco gained access to the required new technologies through acquisitions and partnerships. Cisco maintained its own R&D activity not only by developing new technologies and products but also by acquiring other companies, making agreements for joint-development projects and selling products coming from other companies. This growth model was almost unique in the high-tech world. At that time, distrust among competitors and a common idea that a company looking outside for technological aid was showing its weakness prevented many companies to behave like Cisco. Therefore, leveraging markets as well as technology was not common practice in the Industry. As a result, recently, Cisco's acquisition policy has scooped up some 160 companies over the last 10 years. "In any year there are at least 10 companies we are trying to integrate", said Angel Mendez, Cisco's senior vice president of worldwide manufacturing.^{2,5}

CISCO's Supply Chain

Cisco's supply chain has been evolving to a prevalence of outsourcing and globalization. Twenty years ago Original Equipment Manufacturers in the electronics industry were more vertically integrated; performing mostly their own manufacturing. However, nowadays Cisco relies on contract manufacturers for almost all of its manufacturing needs, reaching more than 95% of their 12,000 products. Cisco uses a variety of independent third-party companies to provide services related to printed-circuit board assembly, in-circuit testing, product repair and product assembly.²

Arrangements with contract manufacturers are carefully crafted to guarantee quality, cost and delivery requirements, as well as capacity, cost management, oversight of manufacturing and conditions for use of their intellectual property. Cisco has not entered into significant long-term contracts with any manufacturing service provider. The company generally has the option to renew arrangements on an as-needed basis, formalized mainly in yearly agreements. These arrangements generally do not commit Cisco to purchase any particular quantities, beyond certain amounts covered by orders or forecasts covering discrete periods of time, defined by default as less than one year.

Additionally, the Cisco outsourced model became more sophisticated when it came to internalize the challenges of Cisco's strategy of using acquisitions and partnerships in order to expand. Most of these companies had their own supply and manufacturing facilities around the globe, whose products should be delivered through Cisco's existing distribution channels. However, the main explicit acquisition criteria for deciding in which companies to integrate, was not only to achieve short term and long term gains, share similar understanding of the market or similar culture with Cisco, but also to have a similar risk-taking style.^{3,5}

This manufacturing model was explained by Carl Redfield, Cisco Vice president of manufacturing and logistics at Cisco, in these terms: "Cisco wants to add value by managing the supply chain and focusing on product design and development". Exhibit 1 summarizes Cisco's current value chain challenges which are the main drivers for Cisco's current business model.^{5,6}

Complementarily to outsourcing and globalization, Cisco tried to boost efficiency. In early 2006, Cisco formally introduced the orientation towards just-in-time manufacturing based on a "pull model" known as Cisco Lean.² The goal of this model was to convert Cisco and its extended supply chain into a system in which the product is

configured to order and it is finally built only after a customer has actually ordered it, using mostly standard components.² Lean orientation combined with a great level of outsourcing introduced a paradigm shift within Cisco's supply chain, moving from the very traditional view to the holistic end-to-end view supply chain management (see Exhibit 2).

In order to reach efficiency, the lean model required Cisco to have as few suppliers as possible. However, contingencies in a tense supply chain may need some levels of redundancy in sourcing to assure availability. But while reducing the base of suppliers, Cisco had to face several additional challenges from the lean model. They needed to reduce inventories while hoping for shorter and more predictable lead times across an easier to control and synchronize extended supply chain. Lean approach also encourages component standardization. It faces product differentiation demanded by the market through different configuration of these standard components.^{2,7}

Cisco's key supply chain decision makers understand supply chain as a dynamic system that need to be continuously adapted to the current context in which they are operating. "Nowadays, activities are much more intertwined from an operational as well as financial point of view. We are driving an adaptive supply chain in a very large outsourced model across a very large spectrum of products and geographies. This is somewhat unique", expressed Mendez.² This way of managing the supply chain placed Cisco's supply chain in the sixth position in the prestigious Gartner's Supply Chain Top 25 in the 2011 ranking.

The consequences of this pattern of changes towards a very disperse network have been quite relevant. Cisco's supply chain has become extensively stretched to significant levels of supply chain dependence on globalization. The opportunities provided by the benefits of outsourcing together with globalization have been the main driver for supply

chain to fully focus on seeking efficiency. But this efficiency is not free and now Cisco's supply chain is facing higher vulnerabilities.

Supply chain risks

Today's electronics supply chains face risks from many factors including political upheavals, regulatory compliance mandates, increasing economic uncertainty, rapid changes in technology, demanding customer expectations, capacity constraints, the effects of globalization or natural disasters. "These threats may come from both internal and external sources of risk", explained Steele. The first one, related to contingencies inside the supply chain, has to do with how the supply chain is looking for efficiency.⁸ Some actions can be taken by the supply chain manager to prevent and control these internal forces, for instance, process orientation action, prevention, monitoring supply chain key nodes and visibility.

External sources of risk arise from the organization's exposure to the external environment, i.e. natural hazards, economic sources or market sources of risk. Compared to the first set of sources, external risks are mainly influenced by globalization where the company has imperfect and incomplete control over the external environment. Cisco is aware of how vulnerable may be its business due to the current world scenario affected by the global economic downturn. This environment marked by market uncertainty brings potential threats to which Cisco is paying attention to like foreign currency exchange rates, economic weakness, adverse tax consequences, political or social unrest or trade protection measures. Some of them may affect their ability to import or export products, which is a key activity in a seamless supply chain within a global market.³ To diminish the potential effects of external risks, the involvement of C-level executives is required as well as collaboration with

stakeholders. Monitoring the market, the political scenario, the weather, the economy and other extraordinary events is also essential.⁸

At the time of the tsunami in Japan, Cisco optical server routers were configured-to order, having a disperse network of diverse tier and sub-tier suppliers coming from different world regions (see Exhibit 3). From the suppliers of raw materials, such as resins, to the direct tier 1 supplier of complex optical line card, passing through intermediate sub-tier suppliers, all of them are potential single points of failure that could start a chain of harmful reactions. “Now we don’t have tons of inventories when a disruption surprises to us. But our customers for optical service routers desire products with low lead times and high responsiveness levels”, exclaimed Steele, regarding the restriction of inventories within a global network base of suppliers.⁷

When the tsunami happened, the vulnerabilities of the optical service routers supply chain became evident. In fact, one of the main raw material suppliers lost more than 50% of its capacity. A supplier for assembled components faced important problems due to its location close to the tsunami area. Transportation carriers, moving some subcomponents to this assembler, failed. Other suppliers faced product quality issues due to the lack of manpower. Additional effects occurred as a consequence of these supply chain discontinuities. For instance, manufacturing lead times became longer and some customers, so as to ensure availability, made the same orders twice, or even three times, through several sales channels and later cancelled the orders upon receipt of the product. This effect, along with other factors, caused important distortions in sales prediction and subsequent inventory assessment.³

Furthermore, Japan’s tsunami brought the importance of cultural differences to light. The supply network for this router based in Japan was culturally heterogeneous compared with Cisco’s US based command, with different ways and procedures for

perceiving threats as well as risk assessment and mitigation. “Not all our suppliers and other stakeholders had the same risk specification. From Cisco’s headquarters we were worried from the very first tier supplier to guarantee long term end-to-end supply. While one of the raw material suppliers promised that the tsunami was going to have very minimum effect on Cisco’s components, we knew that its capacity had been extremely damaged”, explained Steele. Such was the relevance of the cultural issues, that they were treated as critical in the overall supply chain risk management at Cisco.⁹

Supply chain risk management

“Cisco’s proactive approach and leading supply chain risk management capabilities were key to ensuring minimal impact to our customers during the Japan earthquake crisis” (John Chambers, Chairman and CEO, Cisco Systems).

Cisco started to understand the importance of managing risks for ensuring supply chain performance, when they started to deploy the business continuity planning (BCP) in 2004 (see Exhibit 4). Cisco’s BCP program aimed basically to implement actions for risk mitigation, but these efforts were mainly **reactive** in nature since they were basically managing a crisis when it occurred. It identified critical business processes, people and systems related to their supply chain network. They built a BCP dashboard with data for helping the crisis management team to determine the impact of any disruption which allowed them to achieve certain level of mitigation. They categorized the potential disruption based on the result of multiplying the risk of the incident by the financial impact.¹⁰ However the reality showed that this reactive incident-based risk approach proved to be of minimal use since “we were always guessing wrong”.¹¹ It was just useful into “scaring the business” into providing funds to continue developing the

supply chain risk management program, as well as establishing the basis for starting the maturation of a very advanced approach.⁷

Hurricane Katrina in 2005 instigated the challenge of taking a step forward from their reactive approach for managing supply chain risks. In the aftermath of the hurricane, Cisco released more than US\$1 billion into the distribution channel to aid telecom infrastructure recovery. But, Cisco was not able to assess where the product was or the impact on the company from a financial point of view.⁷ “We needed a more **proactive** management, complementary to the previous one that would allow us to use the business continuity planning as an assessment tool”, Steele remarked.¹¹ As a result of these reflections, the company developed beforehand response playbooks which listed strategies and responsibilities for taking action, specified by the type of catastrophe and disruption type as well as the specific region and anticipated duration. That provided a framework for organizing an incident response team, monitoring the crisis and the subsequent events that might disrupt Cisco’s supply chain. Such assessment is particularly relevant for highly engineered components in electronic commodities like Cisco’s. The more advanced business continuity plan helped to identify supply chain nodes and assess the Time-To-Recovery for each node. Time to Recovery is based on the longest recovery time for any critical capability within a node and it measures the time required to restore 100% output at that node when a disruption occurs.¹⁰ It can be measured against multiple factors at the component level as well as at the manufacturing and test levels.¹¹ In reference to this, within 48 hours after the 2008 Chengdu earthquake in China, Cisco was able to conduct a full impact analysis, assessing the time needed to restore the network. This fostered complete visibility into the supplier footprint in the area and the initiation of a crisis survey targeted at the suppliers’ emergency contacts.¹²

Specifically, for the financial crisis at the end of 2008, Cisco deployed a financial risk assessment with the main purpose of categorizing single sourced parts suppliers that could have an important impact on Cisco's economy in green, yellow and red. When five of the red suppliers ended up in bankruptcy, Cisco had already instituted them as "last-time buys" or "second sourcing". The result of this pre-assessment was conducted with no final effect for the operations run by Cisco from such a suppliers' disruption.^{7,12} At this point, Cisco was aware of how dynamic its supply chain was, driven by globalization, outsourcing and efficiency. This dynamics required to establish coherence between the supply chain evolution and the supply chain risk management evolution. The way they configured and designed a supply chain introduced external and internal risks and therefore an additional effort for better managing risks was needed from the very start of the supply chain design. This was in 2010 when they started a new stage in this challenge by adding what they called the "**resiliency** management innovation" to the combination of the reactive-proactive approaches already established at previous stages (see Exhibit 4).

"We realized the real potential to assess the ability of our supply chain so as to return to the original operational state after being disturbed by external or internal factors. However, this was not proactive enough", mentioned Steele referring to how they matured their understanding about resiliency by taking this next step into the evolution of their supply chain risk management.¹¹ This meant integrating the resiliency concept as part of product innovation as well as supply chain process innovation and integrating the notion of "design for resiliency". Cisco upper management was aware that this implied a significant cultural change internally at Cisco for the organizational engagement required, as well as externally in its expanded and diverse value chain. This new stage implied to de-risk the products and supply chain (nodes, suppliers,

equipment, manufacturing and logistics) beforehand, in order to be prepared when an important incident could damage them.⁷

For product de-risk, Cisco selects alternative components in the bill of materials, uses already existing components and component risk buffers, qualifies additional manufacturing sites and specifies alternative test procedures. This is when these products can enter production with low indexes of risk. All these efforts for de-risking a product should be combined with efficient demand forecasting tools for avoiding product shortages. As a result, Cisco estimates that a de-risked product can save approximately US\$1 million.⁷

For supply chain de-risk, Cisco integrates risk awareness while innovating the supply chain. It consists of proactive efforts in the design and execution of the supply chain, in terms of processes, manufacturing sites, transportation routes and external services, with the main purpose of reducing post-disaster recovering. The supply chain resiliency team works closely with manufacturing operations, logistics and transportation service providers and partners to identify network nodes that are out of risk qualification tolerances as well as to develop resiliency plans.¹²

In March 2011 James Steele, spoke about Cisco's supply chain risk management evolution: "In the past, supply chain operations was "cared-about" only when things went wrong. The focus was not on increasing the business, but on keeping the trains running on time. Over the past 15 years, there has been a sea of change in supply chain management. It has become a strategic capability for many companies, and it continues to get the resources, visibility and focus needed to manage as a platform for growth. For Cisco this "change" has meant an increase in risk intelligence and agility on supply chain resiliency capabilities, which are a key element in this evolution".¹²

70-days after the Japan's tsunami

After launching an intensive 70-day effort at Cisco to mitigate the impacts of the earthquake in Japan, John Chambers, CEO, summoned a debriefing meeting with James Steele, responsible for the supply chain risk management team, John O'Connor senior director of business transformation, and key members of the supply chain management team for Cisco optical service routers. All met together in order to analyze the final impact of the devastating incident.

Steele started the meeting with a presentation highlighting the key results of Cisco's response in Japan (see Exhibit 5). "Our incident management protocol achieved a record-time in the assessment of our network in Japan. In 12 hours the impacts of the event in all of our suppliers, from tier 1 to raw materials, were identified, (up to 300 suppliers). We collected information about the sequence of the incident. The assessment of sub-tiers impacts on Japan's map for Cisco optical service routers at that point in time is presented in Exhibit 6. Due to the endeavor of building proactive resiliency while we designed this supply chain, we have been able to provide visibility of sub-tier risk. This has been the Achilles Heel for deploying the right mitigation actions. Thanks to the very short term effort, customer value teams were able to be positioned to liaise with customers, assessing the customer footprints across the incident occurrence. This resulted in 118 inquiries each managed within a 24-hour response-time-window. We need to receive the final evaluation from the finance department, but we can guess now that Cisco is not going to be impacted by almost any revenue lost", concluded Steele.

Once Steele finished his excellent presentation, Cisco's CEO addressed the meeting attendees: "Being successful in the electronics industry and implementing the greatest technology is not enough, because outsourcing and globalization make the supply chain more and more vulnerable. Disruptions provide a unique opportunity to enhance our

capabilities”. He was aware of the important implications and impact of the efforts for mitigating the potential impact of an event of such magnitude and he opened the discussion with the following debating questions:

- How has the evolution of Cisco’s supply chain influenced the complexity of its current supply chain?
- What are the implications of the different vulnerabilities that Cisco has had to face?
- Did the supply chain risk management that was implemented after the tsunami in Japan result in positive outcomes? What worked and what did not and why?
- Which comparable and comprehensive metrics have been required to assess supply chain resiliency capabilities? How can we relate these metrics to the time-to-recovery measurement for all capabilities?
- Can Cisco’s supply chain risk management strategy be generalized for any supply chain?
- Are the supply chain risk-management efforts and budget justified? Does the return on investment of such efforts provide enough justification for their existence?
- What lessons can be extracted from the experience of managing these high-magnitude disruptions? How might Cisco continue to learn to improve the performance of their supply chain risk management?

Endnotes

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- ¹¹ Based on an interview with James Steele, Program Director, Supply Chain Risk Management, Cisco, March 2012.
- ¹² De-Risking the Supply Chain. U.S. Resilience Project, August 8, 2011.

Exhibit 1. Cisco's value chain challenges



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Exhibit 2. Holistic CISCO's Supply Chain



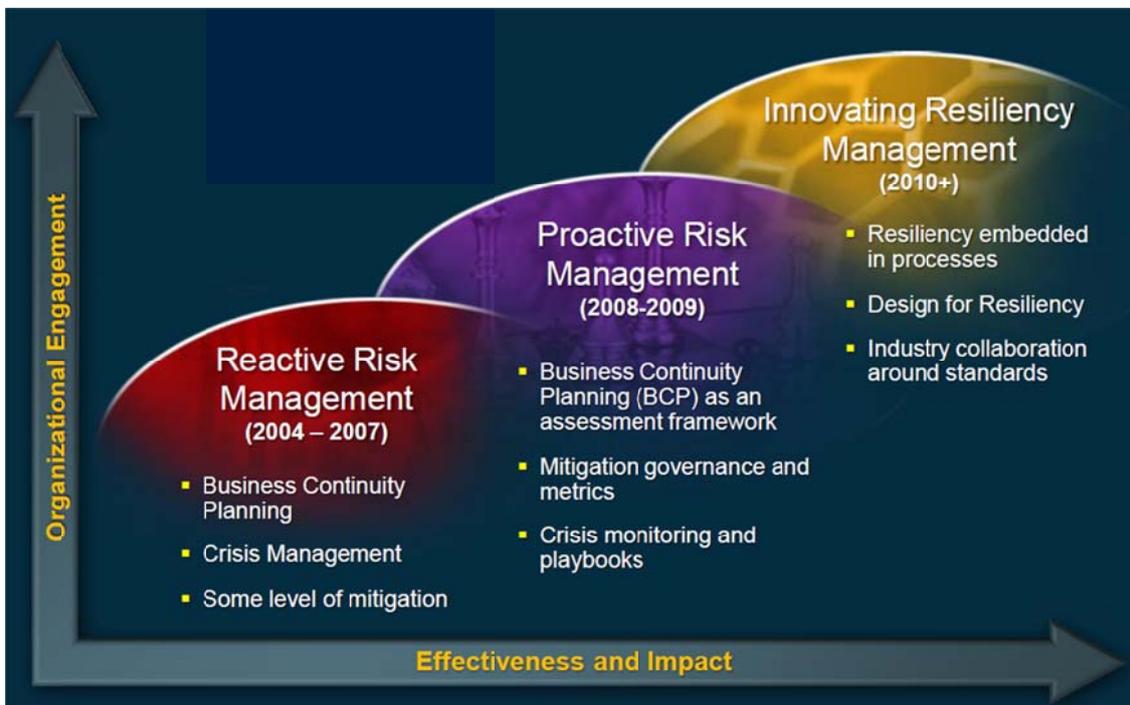
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Exhibit 3. Cisco's optical service router supply chain



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Exhibit 4. Evolution of supply chain risk management at Cisco



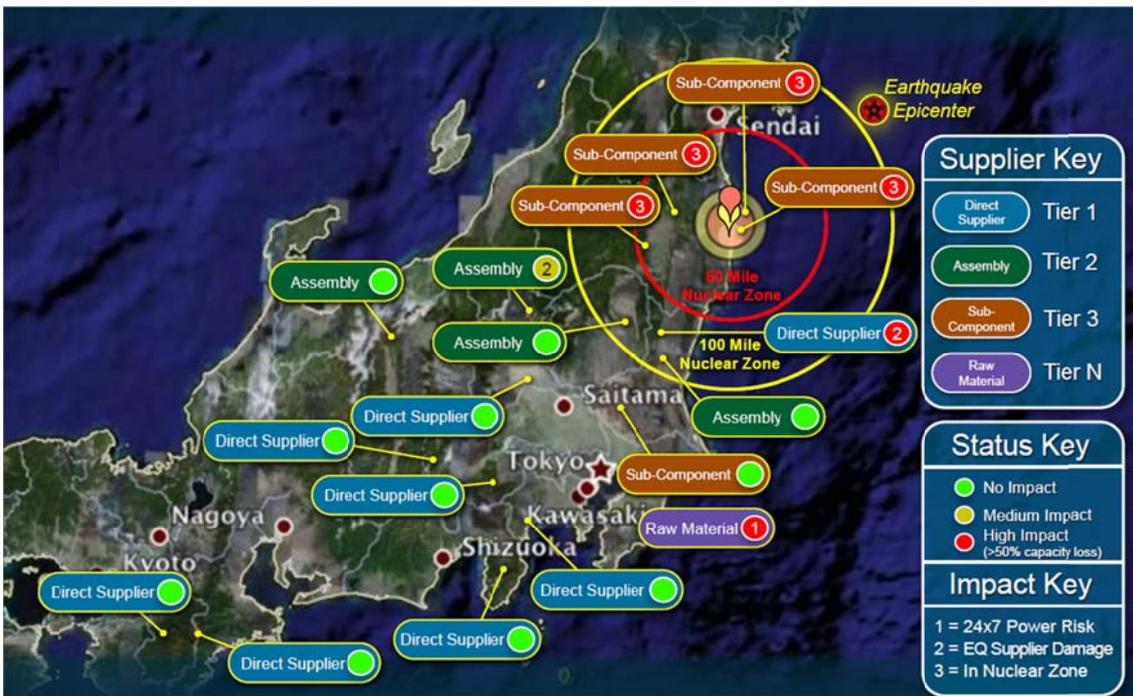
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Exhibit 5. Key results for Cisco Japan response.

Suppliers management:	<ul style="list-style-type: none"> • In 12 hours: all suppliers identified in impacted region • Assessed over 300 suppliers • Assessed over 7000 part numbers and assigned risk rating and mitigation plan
Customer management:	<ul style="list-style-type: none"> • Customer value teams positioned to liaise with customers • Managed 118 customer inquiries, 24 h-responses
Overall result:	<ul style="list-style-type: none"> • Almost no revenue impact

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Exhibit 6. Mapping to assess sub-tier impact



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