

## The CIO Guide to Cfengine

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A Business White Paper

According to Gartner Group, un-planned downtime of mission-critical services is rising together with the number and complexity of datacenter applications. In large organizations the average for un-planned downtime per month is estimated at almost 15 hours per month.

Cfengine Nova brings state of the art automated Server Life-Cycle Management, with attendant best practices for, *Building* systems, *Deploying* updates, *Managing* repairs and *Auditing* the results. Cfengine Nova brings standardization and browsable automated documentation to meet the key datacenter challenges of the next decade.

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## Executive Summary

Server Life-Cycle Management includes control and management of servers from the beginnings of bare metal installation up to their last day of service. Today many organizations depend heavily on legacy methods of human labor and manual process, leading to

- High costs,
- Slow response rates,
- Unpredictable consistency,
- Poor documentation

The ultimate consequence of this is business discontinuity.

According to Gartner Group, un-planned downtime in mission-critical applications is rising, as both the number and complexity of datacenter applications rises. In large organizations the average un-planned downtime per month is estimated to be close to 15 hours per month.

Modern Server Life-Cycle Management requires a sensible division of labor in which humans work strategically, using experience and expertise to develop goals and manage resources, while automation delivers quality assured implementation of goals. This is the cycle of Continual Service Improvement. Cfengine brings repeatable standardization and automated documentation for responsible Knowledge Management. Retaining core operational competence will be the pressing challenge of the coming decade; this is a major focus of Cfengine's approach.

Framework integration with ITIL, COBIT, SAS70 or ISO is straightforward. Cfengine's Knowledge Console is a centre-point for tracking policy and its state of repair. Using Cfengine Nova automation, a business can estimate direct time-cost savings in the region of \$3,000 per server per year. Additionally, the number of incidents due to mis-configurations and unauthorized changes are reduced significantly, in some cases by as much as 70%-90%. Modern methods of automation, pioneered by Cfengine over the past 20 years, bring dependability and quality at a level that was not previously possible.

Installation of Cfengine Nova is a simple process, requiring no extended consultation periods. Cfengine Nova can be up and running in hours, rather than weeks or months. The solution is available for most platforms and can be adapted to legacy or experimental systems with our assistance.

## Business challenges in Server Life-Cycle Management

Server Life-Cycle Management includes controlling and managing a server from its first moments of bare metal installation to its last day of service. Maintaining systems with continuous automated quality assurance is the key to ensuring IT-service availability and business continuity.

According to Forrester Research, IT departments spend a significant amount of time 'provisioning' and deploying resources to meet the demands of business, or repeating work that could be avoided. A key component of total IT costs is the sheer amount of labor spent on maintaining and continuously improving the IT environment for Service Level Management.

The cost of managing a server exceeds the capital cost; the main cost-driver is now labor.

### Lower costs and quicker response rate

A major business challenge is to keep IT costs under control while ensuring IT-service availability. Application complexity will drive the pace of change and hence its cost in the next decade, but still the single biggest cost in many datacenters is labor cost. Gartner Group says; 'people costs still form the largest single cost element for most data centers, sometimes running as high as 40 percent of the overall costs.' By contrast, several current users of Cfengine automation employ only a handful of system administrators to manage many thousands of servers worldwide.

Organizations that cannot automate their operations will continue to struggle with growth as the datacenter evolves and grows. The improvised defense is often to over-simplify operations, limiting the business. According to Forrester Research: 'firms expressing this desire for decreased complexity centers on the fact that having too many unique environments translates into high labor costs, slower problem resolution, and countless other costly activities.'

Mean Time To Repair increases with the number manual steps required to adapt a service or fix an incident. The looming business challenge is to increase response rates not only in repair, but in service *evolution*, to adapt to changing demands. Effective data center automation drives down costs and increases response rate. Cfengine Nova is a powerful and compact automation system that deals with these issues, enabling organizations to support and align more effectively with business initiatives."

### Bringing documentation and consistency

Documentation of datacenter expertise and operations is one of the hardest disciplines for any organization. Many organizations spend a significant amount of money hiring consultant to fill gaps in their knowledge. Lack of internal Knowledge Management thus costs businesses hundred of hours of lost time reinventing existing systems, seeking consultation and re-training staff each year.

Mission critical knowledge is stored often nowhere else than in the heads of 'precious' datacenter experts, who either see no easy way to share their knowledge or are reluctant to do so using Wikis and document systems. Documentation is perceived as demoralizing work and few system administrators possess writing skills to bridge the gap between technology and



business goals. Cfengine attempts to bridge this gap by making it easy to assemble knowledge from manageable hints provided in a form that is palatable to administrators.

Strong Knowledge Management includes acting on documented procedural standards. With Cfengine, anything that is expressed as policy is both automated and documented. Best practice frameworks such as ITIL and other standardization schemes recommend a strong focus on documentation, and CIOs are increasingly tasked to make this a priority.

According to a survey made by Forrester Research, only 21% of the enterprises have implemented tools to bring this kind of consistency. However, in the same survey another 42% said they were implementing or interested in implementing such a tool within the next 12 months: the need is gaining recognition in forward-looking organizations.

Cfengine Nova addresses a lack of documentation and consistency by allowing users to focus on the design of a desired system state, and its *intention*, assured of a consistent handsfree implementation.

## Business continuity – eliminating outages

Outages and un-planned downtime are the single most important challenge in Server Life-Cycle Management. Downtime can result from random mis-configurations or from unexpected events. Most often, it results from human error.

Mid-market, mid-size organizations with 500 to 2,499 employees appear to have the most difficulty with un-planned downtime, according to Gartner Group<sup>1</sup>. 50% of such organizations experience at least six hours of un-planned downtime per month. This is often the result of adopting complex enterprise level application suites, without the corresponding increase in support capability. The Gartner report continues: 'In large organizations, those with more than 2,500 users, average un-planned downtime per month has increased 69%, from 8.7 to 14.7 hours.'

Cfengine Nova brings proactive avoidance of the kinds of issues that lead to downtime, by introducing concrete maintenance measures that bring stable operation. The system also offers insight into trends and patterns in service behaviour that allow experienced administrators to gather their expectations and plan for the unexpected.

## Best practice in Server Life-Cycle Management

Ensuring IT-service availability calls for automation and process documentation. Forrester claims that this will further ease the adoption of cost-reducing technologies. Today, CIOs need to be aware of the capabilities of modern automation methods, and encourage the adoption of solutions that foster a knowledge-driven organization in which the machines implement and the humans plan strategy and work more closely with business units.

Best Practice frameworks are one weapon in the consistency arsenal. ITIL has quickly become a de-facto standard for IT-process standardization, as it forces organizations to think through its processes and document them. Best practice frameworks do not provide tools for implementation however. They are to be used as a human management wrapper around powerful automation software.

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<sup>1</sup> October 2008, Gartner Group report, Dataquest Insight: Unplanned Downtime Rising for Mission-Critical Applications

Cfengine Nova is one of the first products focusing on the integration between Knowledge Management and automated implementation and repair of systems for not just system stability but *organizational predictability*: no surprises means no fire-fighting.

## Introduction to Cfengine Nova's BDMA-model

Cfengine Nova manages the server life-cycle, ensuring a desired operational state, and hence predictable service delivery. It encapsulates processes for each of the different phases of the 'BDMA' life-cycle:

*Build* How to go from bare metal server to any running service 'hands-free'.

*Deploy* Patch and update applications and services automatically.

*Manage* Ensure desired operational state and compliance with policies.

*Audit* Demonstrate control of your environment and prove compliance.

## Expected savings using Cfengine Nova

A simple calculation suggests that an organization with 1000 machines can expect savings in direct labor cost of around \$300.000 per year, using a modest hourly cost. Reductions in manual labor growth are key to scaling up services for growth. A related cost-driver is support-incidents which typically involves two or more persons per thousand systems.

Cfengine Nova is an insurance against outages and unexpected incidents. Its real-time repair technology fixes problems often before they can be reported. With Cfengine Nova, some of the world's largest datacenters manage tens of thousands of machines with less than ten people.

### Reduced hours

Cfengine Nova saves organizations time by reducing the need for manual labor. Nova strongly encourages a shift away from a reactive fire-fighting approaches to management with their ad hoc repairs and standards. It brings a predictive and strategic style that respects human strengths and scales to any number of machines.

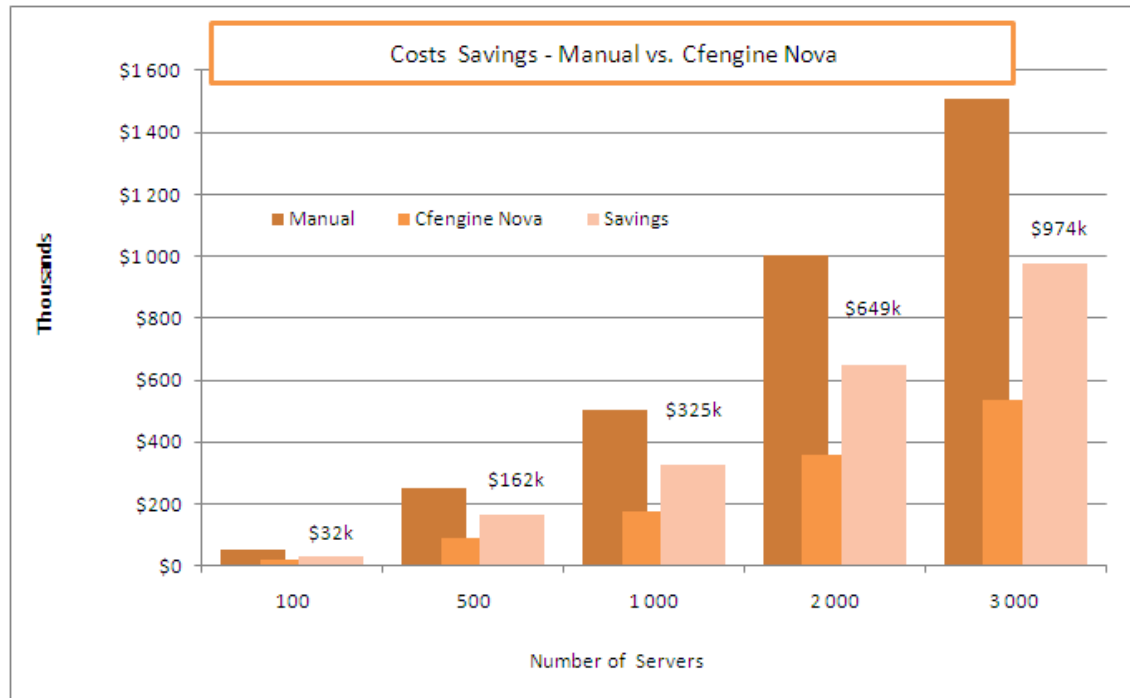
The table below shows estimated time-savings depending on the number of machines under management.

SAVINGS ON SERVER LIFECYCLE MNGT			Number of Servers				
			100	500	1 000	2 000	3 000
<b>Manual</b>	Hours needed		1 396 hrs.	6 980 hrs.	13 960 hrs.	27 920 hrs.	41 880 hrs.
	Expected Costs		\$50 256	\$251 280	\$502 560	\$1 005 120	\$1 507 680
<b>Cfengine Nova</b>	Hours needed		494 hrs.	2 472 hrs.	4 944 hrs.	9 888 hrs.	14 832 hrs.
	Cost per hour		\$17 798	\$88 992	\$177 984	\$355 968	\$533 952
<b>Savings</b>	Hours saved		902 hrs.	4 508 hrs.	9 016 hrs.	18 032 hrs.	27 048 hrs.
	Costs Saved		<b>\$32 458</b>	<b>\$162 288</b>	<b>\$324 576</b>	<b>\$649 152</b>	<b>\$973 728</b>

Assuming a cost of \$36 per hour, costs saved is in the region of \$3.000 per server per year using Cfengine Nova. The graph illustrates expected costs savings when moving from a manual way of working to Cfengine Nova. The numbers include all the phases in the life-cycle



(Build, Deploy, Manage, Audit) BDMA. The big savings are a consequence of reduction in alarms and support incidents.



The details of these numbers can be found in the Appendix, with numbers based on Cfengine's own experience and customer references. Expected savings will vary from organization to organization, so we have been intentionally conservative.

## Reduced incidents

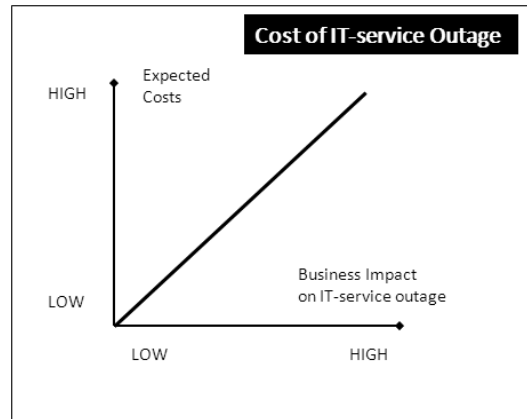
In 1998, Cfengine's author Mark Burgess wrote: *'We dance for our computers. Every error, every problem that has to be diagnosed schedules us to do work on the system's behalf.'* Little has changed in IT operations for many organizations since then. At Cfengine, we work constantly to change the technology landscape and its acceptance of this view in the industry.

Cfengine Nova makes machines work for themselves and for humans, fixing issues automatically without the need to interrupt people from productive work. Repairs are logged and reports can be viewed when it is convenient to do so. It is no longer necessary to be looking over the shoulder of the system all the time. The reduction of disruptive incidents will also be mirrored by a reduction in the severity of the incidents that do occur.

## Reduced outages

The cost of IT-service outage depends its business impact. Using Cfengine Nova automation, the probability of business discontinuity due to IT-service outage is reduced. The value of this reduction can be hard to imagine, let alone quantify if your organization has not established the relevant metrics. Let us propose a simple approach below.





To calculate the business case for Cfengine Nova, the value of reduced outages cannot be over-emphasized. We suggest adding the individual impacts of each IT-service to the business. The expected impact is then:

$$\text{Impact} = \sum_{i=1}^n (\text{IT\_Service}_i \cdot E(\text{Value}_i))$$

where the business value of an IT-service outage can either be a function of reduced sales (a negative number):

$$\text{Value} = E(\Delta \text{Sales\_per\_unit\_time}) \times \text{Outage\_time}$$

or increased costs (a positive number):

$$\text{Value} = E(\Delta \text{Costs\_per\_unit\_time}) \times \text{Outage\_time}$$

both calculated in terms of standard time units. The longer the outage, the bigger the impact on the business.

The total savings brought by Cfengine Nova could take into consideration the following parts, with example for 1000 managed servers.

	Value of reduced hours labor	\$325,000
+	Value of reduced incidents	≥ 0
+	Value of reduced outages	≥ 0
=	Total value of cfengine	≥ \$325,000

## Easy to get started with Cfengine Nova

The automation industry has excelled at 'brute-force' approaches to management – applications built on yesterday's technologies, such as databases and alarm centers. These systems are resource hungry and notoriously complex to install. Open Source software brings transparency and we have packaged the software for commercial use.

After installation, organizations need a methodology. Most management software indirectly encourages a small number of major roll-outs and deployments, in what becomes risky upheavals, because they push the complexity back onto humans.

Cfengine Nova rejects this view in favor of continuous, evolutionary, incremental (low risk) changes that cause very little disruption to users and can usually be made without downtime. These small but frequent drills, keep staff aware of procedures and confident in their ability to cope with change. Using Cfengine, administrators can also grow into these methods slowly, beginning with single process, and gradually encompassing as many as possible, automatically documenting resources and relationships as they go.

In other words, low entry barriers both in terms of expense and complexity makes it easy to get started with Cfengine Nova. Moreover, as a leading Open Source design, you will never run the risk of 'vendor lock in', and users will have the advantage of a world of Cfengine users in an active forum to share experiences with, all speaking a common language.

## Conclusions

IT-departments are enablers of business value, but are too often slated as cost centers. They can be run by a small and highly qualified staff with a focus on standardization and proactive planning, delivering major value to the business.

Industry practices and requirements from ITIL to SOX, SAS70 to PCI, etc, shape the constraints on today's technical goals for Quality Assurance, and using smart but simple automation software<sup>2</sup>, these assurances need not interfere with crucial service delivery.

Cfengine Nova delivers state-of-the-art Server Life-Cycle Management software and methodology, with automated processes for building, deploying, managing and auditing datacenter resources. Using Cfengine in the datacenter provides the assurance of robust services and significant savings through improved business agility and continuity.

Cfengine is the original configuration management system, run by leading organizations all around the world. It is prevalent in banking, finance, insurance, oil/gas, military and governmental installations. Cfengine Nova reduces incidents and and delivers continuous cross-platform compliance without human attendance. Cfengine runs on more than 1 million machines worldwide and is being used by industry leaders across the world.

Cfengine is a privately owned company with offices in Oslo, Norway and Florida USA.

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<sup>2</sup> Cfengine Nova is smart because it is simple in concept.



## Appendix A Introduction to the BDMA-model

Build new machines successfully with Nova

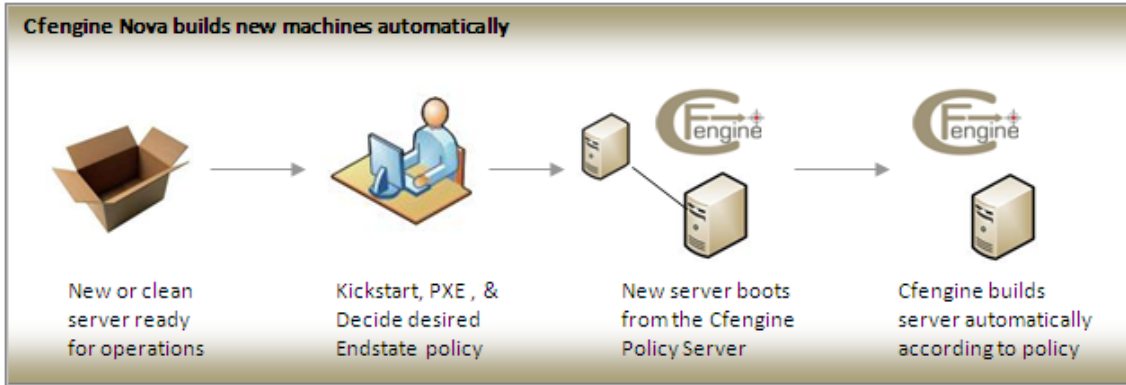


Figure 1 : How to use Nova to build new machines automatically

The main benefits of an automated and policy enforced build process are:

- Zero Touch Process without need for human interaction
- Ensured standard and consistency
- Economies of Scale
- Build more in lesser time

Please see below for more details on the calculations.

SAVINGS BUILD-PROCESS		Number of Servers				
		100	500	1 000	2 000	3 000
Savings	Hours saved	200 hrs.	1 000 hrs.	2 000 hrs.	4 000 hrs.	6 000 hrs.
	Costs Saved	\$7 200	\$36 000	\$72 000	\$144 000	\$216 000

Deploy application updates successfully

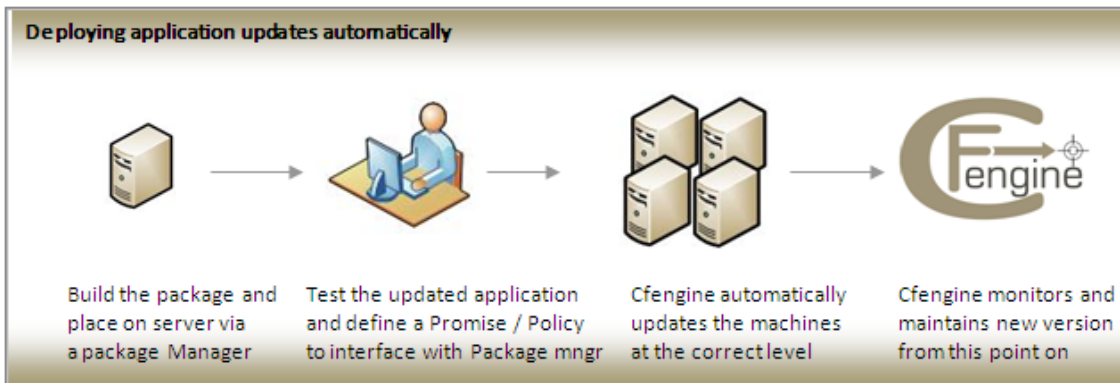


Figure 2 : How to use Nova to deploy application updates

Many benefits can be expected by using a policy enforced deploy process. The most important are:

- Updates are deployed consistently
- The success is increased due to consistent configuration management
- The change process is automated and under control
- The change management reporting is automated and easily accessible

Assuming 4 updates a year, each update requiring 1,15 hours with a labor cost of \$36 per hour, managing 1000 servers will result in cost saving in the region of \$90.000 per year. The added value of consistency and being sure the latest patches and updates are actually installed must also be taken into account. Please see below for more details on these calculations.

SAVINGS DEPLOY-PROCESS		Number of Servers				
		100	500	1 000	2 000	3 000
Savings	Hours saved	260 hrs.	1 300 hrs.	2 600 hrs.	5 200 hrs.	7 800 hrs.
	Costs Saved	\$9 360	\$46 800	\$93 600	\$187 200	\$280 800

### Manage IT-services and ensure desired end state

According to industry analysts the ratio of servers per system administrator are between 25 and 40. Organizations that have implemented a automation system fully, deliver a ratio of one system administrator per 4-5.000 machines.

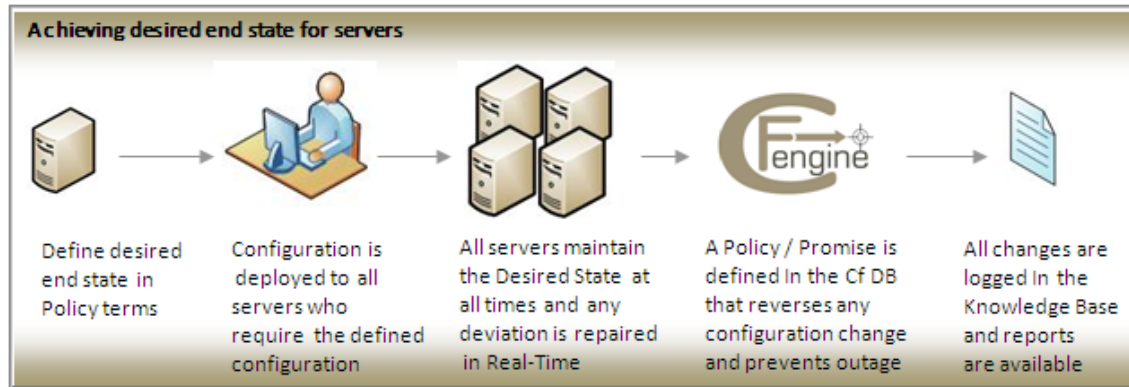


Figure 3 : How to use Nova to ensure desired end-state

With Cfengine Nova, you can expect a reduction in the number of support incidents related to managing your applications, by at least 70%. If you have 1000 servers under management and get 0,5 incidents per server per month, needing one hour a labor work to respond and fix the request, savings in the region of \$150.000 can be expected. Business discontinuity often is a result of mis-configurations and mismanagement of the servers. Letting Cfengine manage the servers, will drastically decrease the probability of IT-service outages.

SAVINGS MANAGE-PROCESS		Number of Servers				
		100	500	1 000	2 000	3 000
Savings	Hours saved	420 hrs.	2 100 hrs.	4 200 hrs.	8 400 hrs.	12 600 hrs.
	Costs Saved	\$15 120	\$75 600	\$151 200	\$302 400	\$453 600



Audit Ensure effective and successful audits

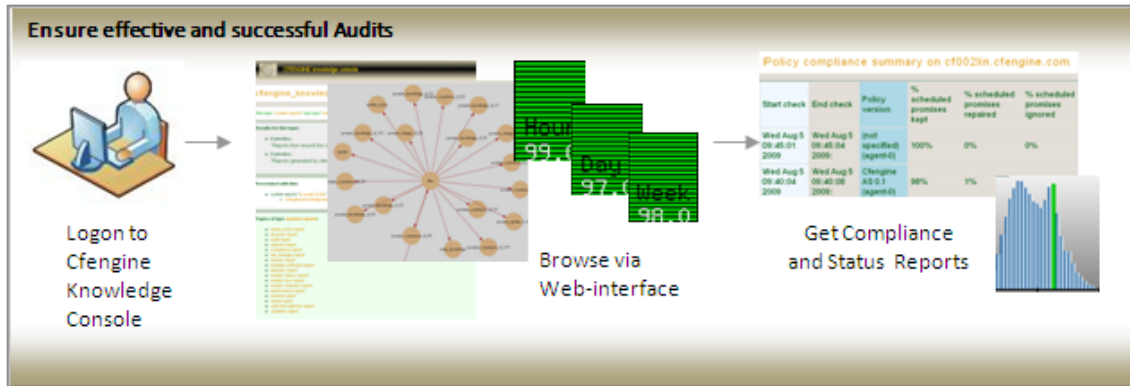


Figure 4 : How to use Nova to ensure compliance

All changes, configurations, settings, etc. can be traced in Cfengine Nova. From the Knowledge Console, you will have access to reports from low-level to high-level. The innovative topic-map allows you to browse around your datacenter assets and policies to discover and learn how things fit together.

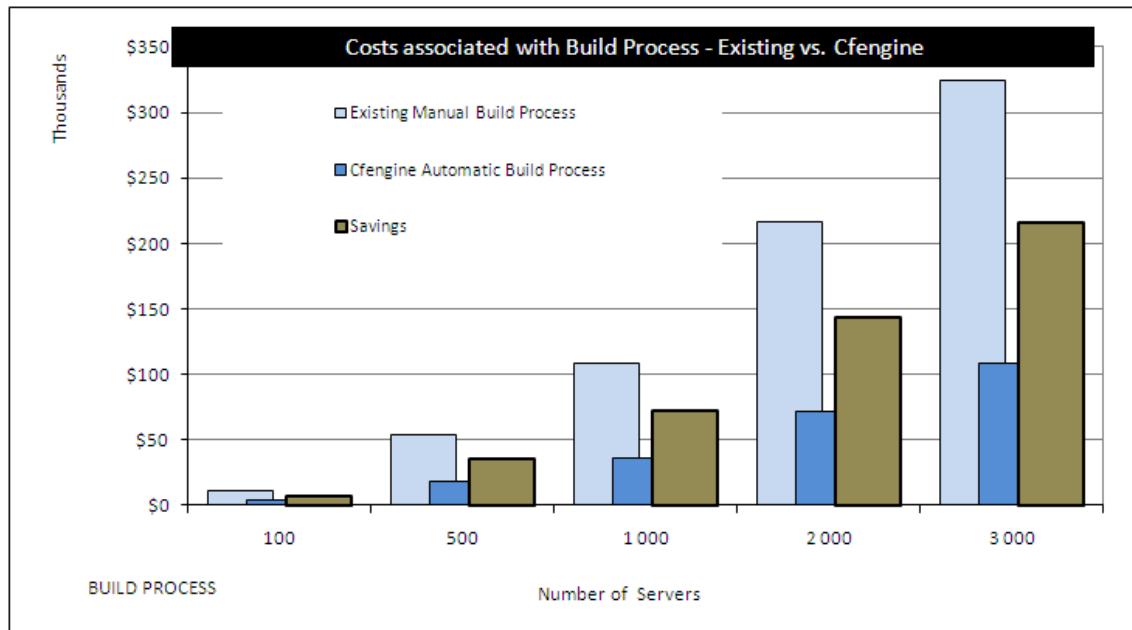
SAVINGS AUDIT-PROCESS		Number of Servers				
Savings	Hours saved	22 hrs.	108 hrs.	216 hrs.	432 hrs.	648 hrs.
	Costs Saved	\$778	\$3 888	\$7 776	\$15 552	\$23 328

Expect to spend 100 hours less on auditing if you have 1000 server under management. Close to \$8000 in reduced labor costs in relation to auditing processes is likely. The biggest value however is the tacit value of being able to demonstrate control of your environment and prove compliance effectively.

## Calculations

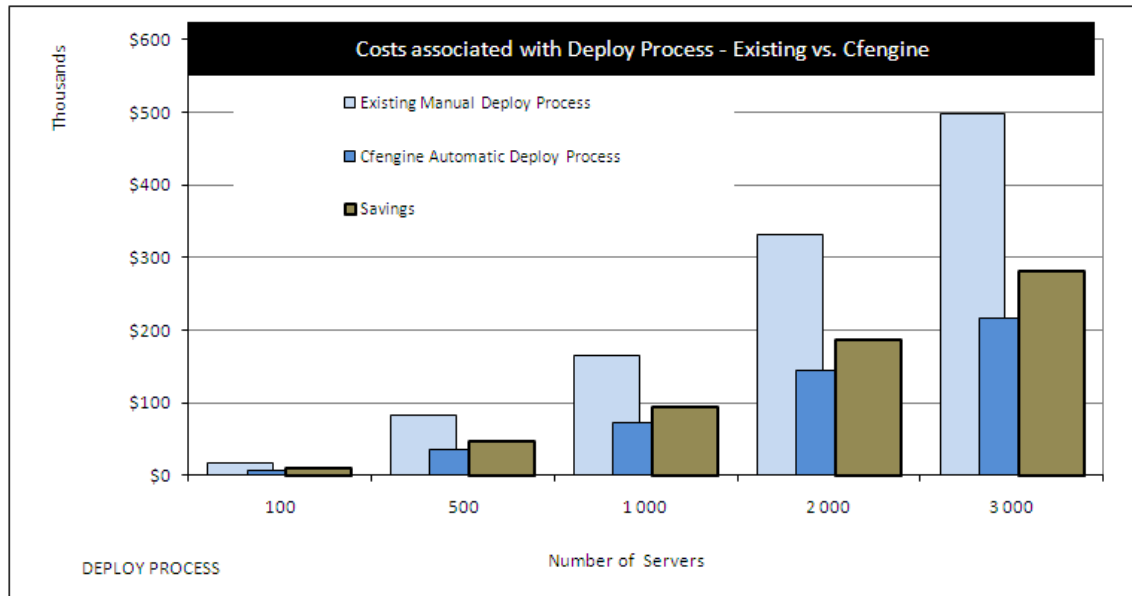
### Savings - Build process

<b>SAVINGS BUILD-PROCESS</b>		<b>Number of Servers</b>					
		<b>100</b>	<b>500</b>	<b>1 000</b>	<b>2 000</b>	<b>3 000</b>	
<b>Existing Manual Build Process</b>	Hours needed	3	300 hrs.	1 500 hrs.	3 000 hrs.	6 000 hrs.	9 000 hrs.
	Cost per hour	\$36	\$10 800	\$54 000	\$108 000	\$216 000	\$324 000
<b>Cfengine Automatic Build Proc</b>	Hours needed	1	100 hrs.	500 hrs.	1 000 hrs.	2 000 hrs.	3 000 hrs.
	Cost per hour	\$36	\$3 600	\$18 000	\$36 000	\$72 000	\$108 000
<b>Savings</b>	Hours saved		200 hrs.	1 000 hrs.	2 000 hrs.	4 000 hrs.	6 000 hrs.
	<b>Costs Saved</b>		<b>\$7 200</b>	<b>\$36 000</b>	<b>\$72 000</b>	<b>\$144 000</b>	<b>\$216 000</b>



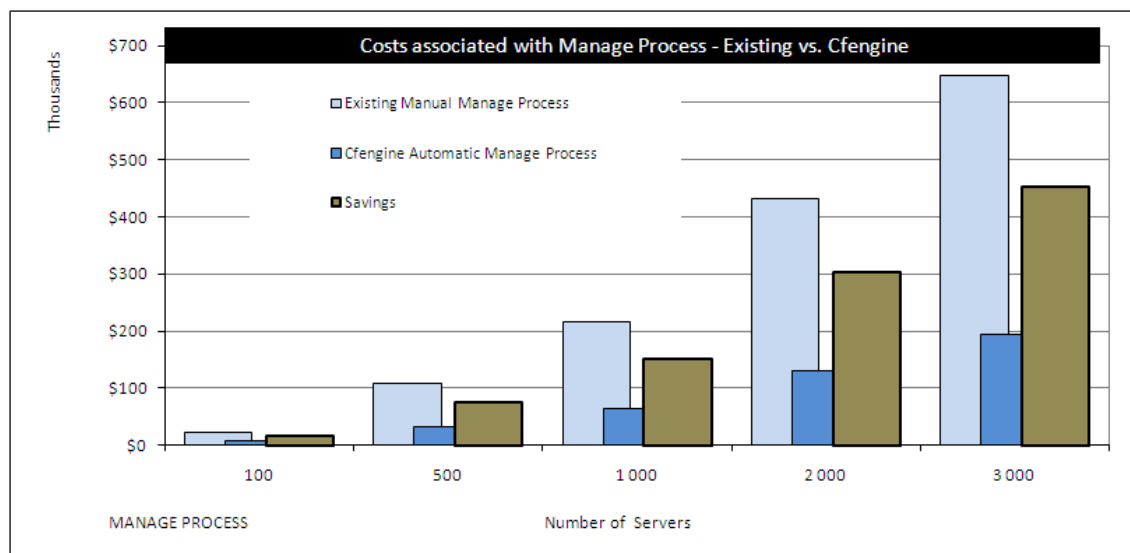
Savings - Deploy process

SAVINGS DEPLOY-PROCESS			Number of Servers				
			100	500	1 000	2 000	3 000
<b>Existing Manual Deploy Proce:</b>	Hours needed	1,15	460 hrs.	2 300 hrs.	4 600 hrs.	9 200 hrs.	13 800 hrs.
	Times / Year	4					
	Cost per hour	\$36	\$16 560	\$82 800	\$165 600	\$331 200	\$496 800
<b>Cfengine Automatic Deploy Pro</b>	Hours needed	0,5	200 hrs.	1 000 hrs.	2 000 hrs.	4 000 hrs.	6 000 hrs.
	Times / Year	4					
	Cost per hour	\$36	\$7 200	\$36 000	\$72 000	\$144 000	\$216 000
<b>Savings</b>	Hours saved		260 hrs.	1 300 hrs.	2 600 hrs.	5 200 hrs.	7 800 hrs.
	<b>Costs Saved</b>		<b>\$9 360</b>	<b>\$46 800</b>	<b>\$93 600</b>	<b>\$187 200</b>	<b>\$280 800</b>



Savings - Manage process

SAVINGS MANAGE-PROCESS			Number of Servers				
			100	500	1 000	2 000	3 000
Existing Manual Manage Process	Incidents/Server/month	0,5	600 hrs.	3 000 hrs.	6 000 hrs.	12 000 hrs.	18 000 hrs.
	Time spent per incident	1					
	Cost per hour	\$36	\$21 600	\$108 000	\$216 000	\$432 000	\$648 000
Cfengine Automatic Manage Proc	Incidents reduction	70 %	180 hrs.	900 hrs.	1 800 hrs.	3 600 hrs.	5 400 hrs.
	Cost per hour	\$36	\$6 480	\$32 400	\$64 800	\$129 600	\$194 400
Savings	Hours saved		420 hrs.	2 100 hrs.	4 200 hrs.	8 400 hrs.	12 600 hrs.
	Costs Saved		\$15 120	\$75 600	\$151 200	\$302 400	\$453 600



Savings - Audit process

SAVINGS AUDIT-PROCESS			Number of Servers				
			100	500	1 000	2 000	3 000
<b>Existing Manual Audit Process</b>	Reports per server/year	36	36 hrs.	180 hrs.	360 hrs.	720 hrs.	1 080 hrs.
	Time per report / server	0,01					
	Cost per hour	\$36	\$1 296	\$6 480	\$12 960	\$25 920	\$38 880
<b>Cfengine Automatic Audit Process</b>	Reports per server/year	36	14 hrs.	72 hrs.	144 hrs.	288 hrs.	432 hrs.
	Time per report / server	0,004					
	Cost per hour	\$36	\$518	\$2 592	\$5 184	\$10 368	\$15 552
<b>Savings</b>	Hours saved		22 hrs.	108 hrs.	216 hrs.	432 hrs.	648 hrs.
	<b>Costs Saved</b>		<b>\$778</b>	<b>\$3 888</b>	<b>\$7 776</b>	<b>\$15 552</b>	<b>\$23 328</b>

